

5 HABITAT RESTORATION

5.1 Ecological Context of Site

The project site is located within the Whatcom Creek Estuary at the mouth of Whatcom Creek, immediately upstream of the Whatcom Waterway in Bellingham Bay. Whatcom Creek flows four miles from its origin in Lake Whatcom to its mouth at Bellingham Bay. The creek is located within Water Resource Inventory Area (WRIA) 1, which encompasses:

- The Nooksack River watershed
- Adjacent drainages that enter the Strait of Georgia, Bellingham Bay, Chuckanut Bay, the north portion of Samish Bay, and portions of the Sumas and Chilliwack River watersheds
- Associated estuarine, nearshore, and marine areas

Estuaries and nearshore marine habitat, such as the Whatcom Creek Estuary, typically provide juvenile salmonids with abundant prey during critical growth periods, and refuge from high stream flows and predators. Estuaries also provide both spawning adults and outmigrating juveniles transition or staging sites for the physiological shift from fresh to salt water (Simenstad et al. 1982).

Salmonids from multiple creek and river systems utilize inner Bellingham Bay and the Whatcom Creek Estuary. Chinook, coho, chum, and pink salmon, as well as steelhead and cutthroat trout have all been documented to spawn in Whatcom Creek (Whatcom Conservation District et al. 2001, City of Bellingham unpublished data). Subyearling juvenile chinook and chum salmon are the most estuarine-dependent salmon species, as they tend to have more extended estuary residence times and utilize the inner marsh areas more extensively than other species (Simenstad et al. 1982, Aitkin 1998).

The shoreline of the Whatcom Creek Estuary, however, is comprised of bulkheads or relatively steep banks of solid waste, resulting in substantially degraded habitat functions for juvenile salmonids. The vertical shoreline configuration reduces the surface area of habitat inundated and exposed during tidal cycles, hinders the establishment of marsh vegetation at middle and upper tidal elevations, and accelerates the velocity of stream and tidal flows (which flushes detritus and small fish downstream). This reduction in the extent and diversity of natural estuarine and nearshore marine habitats, such as tidal sloughs,

mudflats/sandflats, sand/gravel beaches and salt marshes, has negatively impacted Bellingham Bay's capacity to support the variety of fish, bird, and crustacean species that were historically abundant. The Whatcom Creek Estuary has been degraded much more dramatically than Bellingham's other estuaries, significantly impairing critical habitat functions, including the loss of transition or staging sites for salmonids' critical physiological shift from fresh to salt water.

5.2 Restoration Needs and Objectives

Degraded nearshore and estuarine habitat in the Whatcom Creek Estuary impacts recovery of the eight species of salmonids that spawn in tributaries to Bellingham Bay—two of which (chinook salmon and bull trout) are federally listed as threatened. Detailed habitat assessments of the area performed by a range of federal, state, and local entities have documented the degraded functions of nearshore/estuarine habitat in the project area. For example, baseline benthic and epibenthic samples recently collected by Western Washington University's Shannon Point Marine Center within the project area documented an extremely low diversity of fauna in this area (populations were dominated by only three species) (Bingham 2002). The highly degraded nature of existing nearshore/estuarine habitat in the project area has significantly impaired the function of this habitat for salmonids and other important stocks documented within the estuary. The interagency Bellingham Bay Pilot Team identified restoration of nearshore and estuarine habitat in the Whatcom Creek Estuary as one of the highest priority actions for the larger Bellingham Bay area (Pacific International Engineering and Anchor Environmental 1999), and has worked to coordinate restoration of the estuary with source control, cleanup, and land use plans, and with other restoration projects performed both upstream in Whatcom Creek and downstream within the Whatcom Waterway.

The overall objective of the proposed restoration elements of this project is to re-establish critical ecological functions of the historical estuarine habitat targeted at juvenile salmonids that were lost as a result of prior filling practices within the Whatcom Creek Estuary. More specifically the project will provide higher functioning early estuarine rearing habitat for Whatcom Creek salmonid populations and estuarine rearing habitat for Nooksack River and other Bellingham Bay salmonid populations. The habitat restoration actions are designed to improve the estuary's ecological functions supporting juvenile salmonids by:

- Increasing availability of upper intertidal shallow water habitat for refuge from predators
- Providing habitat structure that creates refuge from high flow events (high energy refuge)
- Increasing the productivity and prey resources of nearshore habitat through substrate enhancement (benthic and epibenthic productivity) and establishment of fringing emergent salt marsh and fringing riparian vegetation (terrestrial insects)
- Increasing the residence time within the estuary for detritus and small fish (physiological refuge)

Excavating upland fill deposits from the shoreline and widening this stretch of the estuary, and also softening and re-vegetating the shorelines with native species, will restore habitat diversity and functions more typical of a tidally-influenced estuary. Specific restoration actions for the project area include:

- Bank Softening: approximately 1,000 lineal feet of shoreline on both banks of the estuary will be converted to more gently sloped conditions. On the north side the reconstructed shoreline will have a maximum slope of 3H:1V, with most of the intertidal area softened to less than 8H:1V, to facilitate incorporation and retention of fine-grained substrate. On the south side, the vertical bulkhead will be replaced by a 2H:1V sloped shoreline, which will also serve to stabilize the existing bank.
- Increase Aquatic Area: the acreage of intertidal, estuarine habitat within the project area will be increased (particularly on the northern landfill lobe at middle to upper intertidal zones) by converting existing uplands into aquatic lands.
- Increase Riparian Buffer: the acreage of native riparian buffer will be expanded by removal of non-native invasive species, particularly on the northwest bank of the estuary where this buffer is nearly absent.
- Improve public education: enhanced community stewardship to promote long-term habitat protection

The restoration action will be integrated with the overall landfill cleanup project to ensure both short- and long-term water quality protection and to maximize overall project efficiencies, among other elements. Long-term monitoring and adaptive management will also be implemented to ensure the success of the restoration action. Future site use plans

are consistent with maintaining long-term habitat restoration benefits, including more controlled park use on both the north and south banks, and redevelopment of industrial and commercial uses on the north side to new mixed use development. Provisions for public access will be integrated into the restoration design in a manner that protects the restored habitat from intensive human use in this urban environment.

5.3 Northern Landfill Lobe

The northern landfill lobe is currently characterized by steep slopes along the shoreline, fill, and primarily invasive vegetation (Photo 5-1). Habitat diversity and functions more typical of a tidally-influenced estuary will be restored in this area by excavating upland areas to widen the estuary and remove upland fill deposits, and also by softening and planting the shoreline with marsh and riparian vegetation.



Photo 5-1. View of the existing shoreline slope and riparian vegetation along the north side of the Whatcom Creek Estuary.

5.3.1 Upper Slope/Riparian Habitat

The upper portions of the shoreline (above +10 feet MLLW) will be regraded and replanted to provide riparian buffer habitat that more closely resembles what was historically found near the site. Non-native invasive vegetation that currently grows along the shoreline will be removed and would be replaced with woody riparian vegetation (native trees and shrubs). Approximately one half of an acre of riparian buffer habitat will be created within the northern landfill lobe along 500 linear feet of shoreline. This expanded and enhanced riparian habitat will increase nutrient and terrestrial prey inputs into the estuarine system. In the long-term, this habitat will also be a source of detritus and small woody debris that can provide structure for juvenile salmonids, and additional organic inputs to the estuary. Views of the creek from the proposed boardwalk, along with considerations related to future upland development and personal safety, will influence the density and height of proposed woody vegetation.

The upper portions of the shoreline (above +10 feet MLLW) will be constructed in layers. The first two lifts will consist of clean, relatively fine-grained capping material, such as a moderately silty fine sand or equivalent material. The third (surface) lift will consist of 12 inches of manufactured topsoil (60 percent sand and sandy loam, and 40 percent composted organic matter by volume). In areas that will have slopes inclined at 4H:1V or steeper, the upper bank area will be covered with a coconut fiber (coir) biodegradable erosion control fabric.

5.3.2 Lower Bench/Estuarine Marsh Habitat

The lower bench will be restored to support emergent marsh vegetation. Approximately one quarter of an acre of emergent marsh habitat will be created within the northern landfill lobe along 280 feet of shoreline. This emergent marsh habitat will provide prey resources for juvenile salmonids, refuge from predators, refuge habitat for outmigrating juvenile salmonids during their critical transition from fresh to saltwater, and potential refuge from Whatcom Creek's high flow events.

The lower bench of the shoreline begins at elevation +10 feet MLLW, where the surface would become a relatively flat slope (6H:1V or flatter) to the limit of excavation (+6 feet MLLW). The constructed shoreline between elevation +10 to +6 feet MLLW forms a bench that would be designed to recolonize with emergent marsh vegetation. Between elevation +10 feet MLLW and the Mean Higher High Waterline (MHHW) at elevation +8.5 feet MLLW, high marsh vegetation, consisting of a mixture of native grasses, herbaceous perennials, and a few tree and shrub species is proposed. Species colonizing this zone may include *Potentilla pacifica*, *Deschampsia cespitosa*, *Aster subspicatus*, *Malus fusca*, *Crataegus douglasii*, *Symphoricarpos albus*. Driftwood will be placed in this high marsh zone. This material will consist of logs, with or without root wads. This material could include piles removed from the project area if they are not treated with wood preservatives. This zone is the elevation range where this material naturally would “ground out” and accumulate. Placing this material adds habitat structure that meets the functional criteria for juvenile salmonids. Between elevations +8.5 feet MLLW (the Mean Higher High Waterline) and +6 feet MLLW low marsh vegetation will be planted. This type of vegetation is currently found on the north and south sides of the creek (primarily *Carex lyngbyei*). It grows in a narrow band of elevation based on the degree of tidal inundation it requires (Thom et al. 2000).

The substrate in this bench will be constructed in four separate lifts of material, similar to the cap structure used for the riparian zone. The first two lifts will each consist of 12 to 18 inches of clean, relatively fine-grained silty sand capping material, to achieve a total cap thickness of 2 to 2.5 feet. The third lift will consist of a 6-inch-thick (minimum) layer of armoring gravel to protect against erosion of underlying refuse in a design-level flood event. The final (surface) lift will consist of topsoil that is different than the topsoil used in the upland riparian zone. The topsoil for the marsh will be more moisture retentive and have a lower organic matter content than the topsoil used in the upper bank.

5.3.3 Intertidal Side Channel

Immediately upstream of the marsh bench, a side channel is proposed in the intertidal zone. This channel is approximately 180 feet long and will be constructed out of a gravel and spalls berm with a 2H:1V maximum slope and partly buried, anchored large woody

debris. The top of the gravel berm will be set between +7 and +8 feet MLLW. The bottom of the channel will be two to three feet lower. The berm will also serve to protect the base of the newly re-graded planted slope from erosion by high flow events. Just upstream, Whatcom Creek enters the tidal basin at relatively steep gradient and is pinched by the presence of the fish hatchery concrete bulkhead. These two factors combined generate the highest velocities (and potential erosion) during peak stream flow events affecting the project area. The side channel is designed to create more diverse habitat structure in the intertidal zone within the northern landfill lobe. The channel bottom will trap fine-grained materials for the establishment of a benthic invertebrate community. Anchored large woody debris (18 to 24 inch diameter Douglas Fir or Western Red Cedar logs with rootwads attached) placed on the outboard side of the upstream 80 linear feet of the gravel berm in this intertidal zone will provide habitat structure and refuge, and will trap fine sediments and organic debris. The logs will be anchored in-place using a combination of structural anchors and through their burial within the berm.

5.4 Southern Landfill Lobe

The shoreline along the southern landfill lobe contains remnant portions of a failing wood bulkhead and derelict wooden piling (Photo 5-2).



Photo 5-2. View of the south shoreline section containing a failing wood bulkhead.

Habitat restoration in the southern landfill lobe will involve shoreline stabilization and softening of the slope. Along the downstream 170 feet of the shoreline the bulkhead is relatively intact, but in very poor condition. Along this section, a wedge constructed of spalls topped by gravel is proposed at a 2H:1V slope to buttress the landfill slope and eliminate the vertical bulkhead effect on the habitat. The toe of this buttress is the channel bottom, which varies in elevation (+2 to -4 feet MLLW), and the top is a maximum of +8 feet MLLW (set 0.5 feet below the Mean Higher High Waterline elevation). Along the upstream 280 feet of the south shoreline, the eroded bank will be softened by a combination of excavating near vertical lobes of landfill material and placing gravel and spalls at gentler slopes down to existing grades. The toe of this regraded slope is the channel bottom, which varies in elevation (+2 to -4 feet MLLW), and the top is a maximum of elevation +13 feet MLLW (the existing path edge). Gravel will be placed up to elevation +10 feet MLLW in this location due to the slope. No new riparian or marsh plantings are proposed on the south lobe of the landfill since extensive riparian plantings exist and the new grades are too steep for marsh plantings. Overall, no loss of aquatic area is proposed in this location.

5.5 Public Access

One of the objectives of this project is to improve public education and stewardship in order to promote long-term habitat protection. Public access has been incorporated into the overall project design to address existing community open space goals and planning objectives. Habitat restoration within the Whatcom Creek Estuary will provide an opportunity to educate the public about critical estuarine environments as a result of these public access components.

Within the northern landfill lobe, a new shoreline boardwalk trail is proposed in the middle to upper level of the bank in the riparian zone, and above the lower bench/marsh zone. The trail will run parallel to the shoreline approximately 500 feet and link to Holly Street on the west and the fish hatchery path on the east. From there, the existing access route will ultimately connect to the Whatcom Creek Trail over an existing bridge.

The boardwalk foundation design will be compatible with the cap and refuse beneath it. This trail would be designed to allow for controlled public access and would be wheelchair accessible. Two viewpoint/lookouts will be located along the boardwalk at the Astor Street right-of-way and along the proposed side channel. These viewpoints will allow for better views of the creek and educational activities. The Astor Street viewpoint is intended to align with a future open space corridor/pathway in the future development planned by the City. This viewpoint is larger (15 feet by 30 feet) than the upstream viewpoint (10 feet by 20 feet). Both viewpoints include benches facing the creek.

The southern landfill lobe area is part of the City's Maritime Heritage Park, and already includes an extensive network of trails and interpretive exhibits, along with an environmental education classroom facility. These trails are linked into the larger Whatcom Creek Trail Master Plan. A 180 foot long, redundant segment of trail that will be disturbed by construction will be removed and restored to riparian vegetation. One viewpoint/lookout will be constructed on the upstream end of this segment of deleted trail. This viewpoint will have a similar design to the viewpoints on the north side and will provide controlled access for viewing and educational activities. This viewpoint is 20 feet by 10 feet. This portion of the creek is located in an urban area and currently receives heavy

fishing pressure that needs to be accommodated to protect the restored habitat. The portion of the shoreline where the path is proposed to be removed is a good location to provide access for fishing from the shoreline. Construction of the viewpoint/lookout will not result in any permanent disturbance riparian vegetation. Handrails are included to protect existing riparian vegetation above the fishing access area and downstream of it where the band of vegetation is narrow. Access parallel to the shoreline will be provided by the existing trails to remain.

5.6 Future Plans for Site Use

Areas proposed for habitat restoration will remain in the uses described above. Adjacent to the north landfill lobe restoration area on the north side of the creek, future mixed use commercial/residential redevelopment is proposed by the City. Future adjacent redevelopment concepts will be consistent with the goals of maintaining the long-term viability of habitat restoration and public access benefits of this project.

5.7 Monitoring and Adaptive Management

The significant long-term habitat functional benefits expected to be provided by the project include:

- Increased benthic and epibenthic community production
- Expanded and enhanced rearing area for juvenile salmonids and other resources
- Enhanced migratory corridor for juvenile salmonids
- Improved habitat connectivity between Whatcom Creek and Bellingham Bay

A habitat monitoring plan will be used to investigate, quantify, and verify these improvements to habitat function, by documenting benthic and epibenthic macroinvertebrate re-colonization and juvenile salmonid utilization in the Whatcom Creek Estuary. Details of the habitat monitoring plan were presented in the Project's Compliance Monitoring and Contingency Response Plan (Anchor 2002a)